International Journal of Agricultural
Science and Research (IJASR)
ISSN(P): 2250-0057; ISSN(E): 2321-0087
Vol. 6, Issue 6, Dec 2016, 247-252

TRANS STELLAR
•Journal Publications •Research Consultancy

STUDY OF DIFFERENT COMMERCIALLY AVAILABLE PADDY TRANSPLANTERS IN KONKAN REGION OF MAHARASHTRA STATE

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ABSTRACT

In Konkan region about 71.96% of total cultivable land is under marginal size farms and 25.41% under medium size farms. In this region, wet land cultivation system is followed. Particularly in Ratnagiri district, the status of mechanization is very low. The study was undertaken at Dr. BalasahebSawantKonkanKrishiVidyapeeth, Dapoli, Dist: Ratnagiri Maharashtra state, during kharifseasons of 2015. The experiment consisted of evaluation of field performance of three types of paddy transplanters viz. Eight row self propelled paddy transplanter (YanjiShakti), Four row manual paddy transplanter (CRRI) and Two row hand cranked paddy transplanter. Speed of operation, Theoretical field efficiency, Actual field capacity, Field efficiency, Percentage of missing hills, Percentage of floating hills, Planting efficiency and other performance and operation related observations were taken as per the standard procedure and it was concluded that Self propelled eight row transplanter (YanjiShakti) is found to be better in performance on the basis of lesser percentage of missing hills (3.33%), floating hills (2.72%), better percentage of planting efficiency 95.18%, field efficiency (69.46%) and highest effective field capacity (0.17 ha/h). The transportation of machine from one field to another and higher initial cost were the hurdles. For using manually operated 4 row transplanter (CRRI model) and manually operated 2 rows transplanter (Hand cranked) training of operator was found necessary to maintain the required hill to hill distance and to maintain travel in straight and parallel line.

KEYWORDS: Rice Transplanter, Performance Evaluation, Planting Efficiency, Field Efficiency

Received: Oct 26, 2016; **Accepted:** Nov 08, 2016; **Published:** Nov 10, 2016; **Paper Id.:** IJASRDEC201636

Original Article

I. INTRODUCTION

Rice is a major food grain crop and staple food of millions of people in many countries of the world. About 90 per cent of rice grown in the world is produced and consumed only in Asian countries. In India rice crop is planted in almost all the states on 43.95 Mha area. The total rice production of India was 106.5 Mt in 2013-14 (Anonymous, 2015). In Maharashtra the estimated area under rice cultivation is 1.567 Mha with estimated rice production of about 3.016 Mt and with the estimated productivity of 1.925 t/ha during the year 2013-14 (Anonymous, 2015). To meet the food demands of the growing population and to achieve food security in the country, the present production levels need to be increased by 2 Mt every year. It is estimated that 120 Mt of rice is required to feed the growing population by 2020. (Vasudevan *et.al.* 2014). Konkan region is a hilly terrain and coastal part of Maharashtra between Western Ghat and Arabian Sea with geographical area of the region is 2.95

Mha. In Konkan the climatic conditions are suitable for rice cultivation hence it is the most important crop of the region. The estimated area under rice cultivation is 0.4079 Mha with production of 1.129 Mt and with productivity 2.768 t/ha during the year 2013-14.

In Konkan region about 71.96% of total cultivable land is under marginal size farms and 25.41% under medium size farms (Shahare, 2012). In this region, wet land cultivation system is followed. Particularly in Ratnagiri district, the status of mechanization is very low. Hence the transplanting operation is done manually.

Manual rice transplanting is a tedious and very time consuming job requiring 50 to 60 man days per ha. The cost of puddling and transplanting shares 50 % of total production cost (Shahare and Bhat, 2011). At the time of transplanting, there is acute shortage of labours which results in increasing wages and delayed operation. In spite of huge labour requirement, plant to plant and row to row spacing are not achieved and hence mechanical weeding is not possible. Optimizing plant density and timeliness of operation in paddy is considered essential for optimizing paddy yield which may be possible if dependence on hired labour is minimized (Chaudhury *et al.*, 2005). Mechanical transplanting of paddy could be a solution to the prevailing situation in the Konkan region of Maharashtra to reduce the labours, delay in transplanting and the cost of paddy cultivation.

Therefore a study was undertaken to study the mechanical performance and suitability of the different commercially available paddy transplanters for the prevailing situations of Konkan region of Maharashtra. Three types of paddy transplanters were utilized for the study viz. Eight row self propelled paddy transplanter, Four row manual paddy transplanter and two row hand cranked paddy transplanter.

II. MATERIALS AND METHODS

The study was undertaken at Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist: Ratnagiri Maharashtra state, during *kharif* seasons of 2015. The experiment consisted of evaluation of field performance of three types of paddy transplanters viz. Eight row self propelled paddy transplanter (Yanji Shakti), Four row manual paddy transplanter (CRRI) and Two row hand cranked paddy transplanter. The technical specification of the three transplanters selected for the study are given in Table 1.

Eight row self propelled paddy transplanter (Yanji Shakti) and four row manual paddy transplanter (CRRI) required a special method of raising seedlings called Dapog or mat type seedlings. Raised beds of 10 m length, 1.0 m width and 2.5 cm height for Eight row self propelled paddy transplanter (Yanji Shakti) and 12.5 cm height for Four row manual paddy transplanter (CRRI) were prepared. Soil was sieved and mixed with equal quantity of farm yard manure and spread over the polythene sheet to a depth of 2 cm. Sprouted seeds were spread uniformly on the polythene sheet. The seedlings were grown normally by regular watering. Seedling mat was cut to required size using a knife and rolled and fed to the mechanical transplanter. In case of two row hand cranked paddy transplanter, nursery was raised following the recommended package of practices.

Table 1: Technical Specification of Different Transplanters Selected for the Study

Sr. No.	Specifications	Eight Row Self Propelled Paddy Transplanter (Yanji Shakti)	Four Row Manual Paddy Transplanter (CRRI)	Two Row Hand Cranked Paddy Transplanter
1	Type of machine	Power operated 2.94 KW air cooled engine	Manual	Manual
2	Supplier	M/s VST Agro Inputs, Mahadevapura, Bangalore	CRRI, Cuttuck	Rajkumar Agro Engineers Pvt. Ltd. Nagpur M.S.
3.	Overall dimensions L x W x H (cm)	241 x 229 x 120	127 x 117 x 62	60 x 70 x 80
4	Number of rows	8	4	2
5	Row spacing (cm)	23.8	24.0	25.0
6	Finger type	Fixed type	Fixed type	Actuating type
7	Type of nursery	25 mm mat	12.5 mm mat	Traditional
8	Hill to hill Distance (cm)	12-14	Adjustable	Adjustable

a). Eight Row Self Propelled Paddy Transplanter (Yanji Shakti)

b). Four row manual paddy transplanter (CRRI)

C). Two Row Hand Cranked Paddy Transplanter

Figure 1: Machines Selected for the Study

Transplanting was done through mechanical transplanter by running length wise in the field on the puddled and leveled land with water level in the field kept approximately at 2 cm. The transplanting speed was obtained by recording the time required for the rice transplanter to travel a 10 m distance in the field. Theoretical field capacity and Actual field capacity were calculated based on the theoretical area and actual area covered per unit time respectively. The time loss in turning, feeding the seedlings on tray, repair and adjustment was taken into consideration. Field efficiency was obtained by dividing actual field capacity by the theoretical field capacity.

A hill without seedlings was taken as missing hill and A hill (bunch of seedlings) inspite of properly placing in the puddled soil, just lying on the surface is termed as floating hill. A square quadrant (1 m x 1 m) was used to record the total number of hills, missing hills and floating hills per square meter area. An average of all the readings was taken. Number of missing hills per square meter area was calculated as the ratio of the total number of hills without seedlings to the total number of hills expressed in percentage. Also, number of floating hills per square meter area was calculated as the ratio of the total number of floating hills after transplanting to the total number of hills expressed in percentage. The ratio of the number of hills with seedlings to the total number of hill expressed in

Percentage was taken as Planting efficiency.

The observations related to the preparations for using the machine, ease of operation, feeding of seedlings and transportation of machine among the fields were taken before, during and after the operation of machines.

III. RESULTS AND DISCUSSIONS

Based on the field experiments conducted during *kharif 2015,* it was observed that the number of seedlings

3.1 Effective Field Capacity

The average value of effective field capacity (0.02 ha/hr) was observed lowest in case of two row hand cranked transplanter, followed by four row manual transplanter (0.03 ha/hr) and eight row power operated transplanter (0.17 ha/hr). The lowest value of effective field capacity in case of two row hand cranked transplanter was mainly due to the lesser number of rows transplanted in one pass and due to the low speed of operation as the operator has to crank the machine, pull it by walking in backward direction and maintaining operation of the machine in straight line.

3.2 Missing Percentage

The lowest percentage of missing hills was observed in case of eight row power operated transplanter (3.33%) followed by two row hand cranked transplanter (9.52%) and four row manual transplanter (17.08%) Figure 1. The highest percentage of missing hills in case of four row manual transplanter was mainly due to non-uniformity of seedling stand in the mat and due to the failure of the mat pusher to push the mat properly. In case of two row hand cranked transplanter missing was lesser than four row transplanter because it uses root wash type seedlings and there is no effect of density of seedlings. The missing observed was may be due to the non uniform cranking speed.

3.3 Floating Percentage

The lowest percentage of floating hills was observed in case of eight row power operated transplanter (2.72%) whereas almost equal percentage of floating hills was observed in case of two row hand cranked transplanter (5.67%) and four row manual transplanter (5.71) Figure 2. The highest percentage of missing hills in case of two row hand cranked transplanter was mainly due to the non uniformity depth of water while transplanting and in case of and four row manual

transplanter it was due to the sticking of the piece of seedling nursery mat in the transplanting fork that did not released it in the soil at proper location.

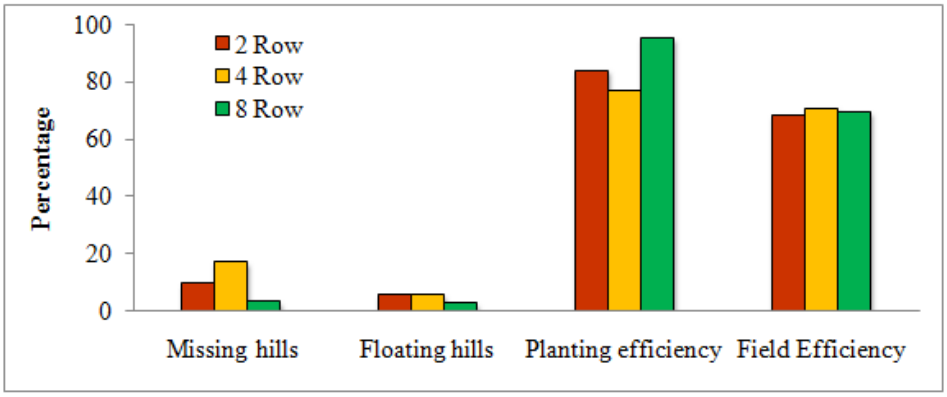

Figure 2: Performance of Different Transplanters Selected for the Study

3.4 Planting Efficiency

Among the machines evaluated, an average planting efficiency of eight row self propelled paddy transplanter (95.18%) was observed highest followed by two row hand cranked transplanter (83.89%) and four row manual transplanter (76.56%) Figure 1. The reasons for this is as postulated above in missing hills and floating hills.

3.5 Field Efficiency

Among the machines evaluated, an average field efficiency of four row manual transplanter (70.76%) was observed highest followed by eight row self propelled transplanter (69.46%) and two row hand cranked transplanter (68.34%) (Figure 1).

3.6 Other Performance and Operation Related Observations

3.6.1 Self Propelled Eight Row Transplanter (Yanji Shakti)

The transplanter requires mat type nursery that requires lot of skill in raising of seedlings on mat which was in agreement of the observation reported by Singh *et al.,* 1981. Also the management of the raised nursery was a difficult task. Fragmentation of land limited free movement of the machine an required more labors to transport the machine. Training of operator is required to operate the transplanter. It had high initial investment also expenditures on plastic sheets and mat frame for raising the mat type seedlings. Sale & service centres are in cities at distant places from farmers' field in case of machine breakdown or problems faced in the field work can suffer as the spares are expensive, machine is composed of complex and precise mechanism that cannot be repaired or serviced in the local workshops. Similar kinds of limitations were reported by Pateriya R.N. and R.K. Datta.2012.

3.6.2 Manually Operated 4 Row Transplanter (CRRI Model)

This transplanter also requires mat type nursery, therefore the limitations and difficulties in raising mat type seedlings are same as explained in the section 4.3.2. Training of operator was found necessary to maintain the required hill to hill distance and the eeffective field capacity was low.

3.6.3 Manually Operated 2 Row Transplanter (Hand Cranked)

This transplanter required training to operator for maintaining the walking speed and cranking speed to get uniform hill to hill distance at the same time to maintain travel in straight and parallel line. The eeffective field capacity was low and the machine cannot be operated continuously for long time due to more efforts required to pull the machine and crank the mechanism at a time.

IV. CONCLUSIONS

- Self propelled eight row transplanter (Yanji Shakti) is found to be better in performance on the basis of lesser percentage of missing hills (3.33%), floating hills (2.72%), better percentage of planting efficiency 95.18%, field efficiency (69.46%) and highest effective field capacity (0.17 ha/h). The transportation of machine from one field to another and higher initial cost are the hurdles.
- For using manually operated 4 row transplanter (CRRI model), training of operator was found necessary to maintain the required hill to hill distance. and average values of effective field capacity, percentage of missing hills, percentage of floating hills, planting efficiency and field efficiency observed were 0.03 ha/h, 17.08%, 5.71%, 76.56% and 70.76% respectively.
- Manually operated 2 row transplanter (Hand cranked) transplanter required training to operator for maintaining the walking speed and cranking speed to get uniform hill to hill distance, to maintain travel in straight and parallel line. An average values of effective field capacity, percentage of missing hills, percentage of floating hills, planting efficiency and field efficiency observed were 0.02 ha/h, 9.52%, 5.67%, 83.93% and 68.34% respectively.

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